

GROUND WATER CLASSIFICATION RULES WITH DEPARTMENTAL GUIDANCE

Guidance for sections of the ground water classification rules are set forth below after the applicable section and are in *italics*. Please note that guidance is instructive and intended to assist the Department in consistently applying the rules, but are not themselves rules and do not carry the weight of law.

RULE:

1200-4-3-.07 GROUND WATER CLASSIFICATION.

(1) Purpose and Intent. It is one of the primary goals of the Tennessee Water Quality Control Act, T.C.A. 69-3-101 et. seq. (the "Act") to protect our valuable ground water resource. This rule classifies ground water across the state based on the factors stated in the Act, T.C.A. 69-3-105(a)(2) and establishes ground water quality criteria. The quality of ground water varies in Tennessee, some aquifers, or portions thereof, produce water with sufficient quality and quantity to be used by our citizens directly as a drinking water supply, other aquifers, or portions thereof, produce water in sufficient quantities to be used as a water supply but the water requires treatment before it can be used as such. Finally, some aquifers, or portions thereof, either have levels of naturally occurring constituents that make the resource unusable as a drinking water supply or the aquifer does not produce enough water to be used as a drinking water supply. The Board recognizes these rules apply to both permitting activities and response actions, as the term response is defined rule 1200-1-13-.02(1)(f). The abatement of pollution is a goal of the Act and these rules. These rules provide appropriate flexibility in the regulatory process to protect our ground water resource. Allowing the beneficial use and/or reuse of brownfield areas for some permitted waste management activities reduces the use of greenfield areas for such purposes; which will conserve and protect our environment. However, the Site Specific Impaired classification does not apply in the context of activities involving areas with no ground water contamination. When ground water has been polluted by human activity, these rules set forth the procedures and standards for any necessary ground water remediation. In certain cases, due to site specific conditions, it may not be technologically feasible to clean up a site and/or the costs associated with such clean up or other factors may substantially outweigh the benefits of the restored resource. These rules establish a Site Specific Impaired classification that may apply in such areas after a thorough evaluation of feasibility of remediation and the potential risk of allowing contaminants to remain in ground water. The Board recognizes that several Divisions within the Department have a role in protecting ground water resources. It is not the intent of these rules to change the responsibilities of those programs. It is, however, the intent of these rules to provide a uniform basis for decisions involving ground water that may be applied by all Divisions of the Department. The Board does not intend these rules to affect in any way the ability of the State to seek natural resource damages from responsible parties when ground water has been contaminated by human activity.

GUIDANCE:

There is no “default” classification for ground water. Rules classifying ground water as drinking water were withdrawn. Ground water is classified as it is encountered according to the requirements in Rule 1200-4-3. The timing of the classification determination is important. At sites that may require remediation, classification may be needed to determine the appropriate cleanup criteria and action(s). It is therefore suggested that appropriate data be gathered during the investigation for determining the classification. This will allow the ground water classification to be established, factored into remedial decisions, and documented in the Record of Decision or other decision documents. While classification can occur at any stage in the remedial process, the classification should not be established prematurely, because once the Department establishes the classification the Department cannot change the classification. Reclassification of ground water may be made only by the Water Quality Control Board. If, for example, it is determined that the ground water meets the quality and quantity requirements to be classified as general use and the Department classifies the ground water as general use, then the Department loses the ability to allow a site specific impaired classification unless there is a reclassification request to the Water Quality Control Board and the Board grants the reclassification. Each Division should identify a formal process by which this decision will be memorialized. The rationale for the decision should be included.

Procedure for Denial of Classification Request.

If staff make a determination that a requested classification should be denied, a further decision must also be made as to whether the groundwater should be classified as general use or remain unclassified. It is within the department’s authority to make either of these decisions. It is not an automatic result of a denial of a request for classification as Limited Use, for example, that the ground water must be classified as General Use. If there is adequate information and a valid reason for making the classification as general use, it may be made, bearing in mind that one consequence is that any later change to that classification will have to be done by the Board as a re-classification in a rulemaking proceeding.

Prior to classifying the ground water, it should be verified that the data used in the ground water classification determination is appropriate for the ground water (area, interval, and aquifer type) being classified. The presence or use of springs and wells is a major consideration in groundwater

classification, as is well yield. Well locations, interval(s) tested, and the time of year when flow tests are performed can have dramatic implications on well yield. In some areas such as those underlain by limestone, the flow may vary greatly depending on the location and interval tested. For example, wells may yield significantly different results if slightly fractured dense limestone is tested or if water filled bedding planes connected to permeable, saturated joints, faults or caves are tested. These intervals may be present in the same hole or boring. If the permeable water producing interval(s) is/are cased off or are otherwise not tested, the yield measured by testing could be biased low. It is conceivable that there could be different classifications for different intervals in the same hole. Likewise, since fractures or permeability vary laterally, yield may vary between wells a few feet apart. Flow paths and zones of saturation may also vary seasonally. Therefore, the number of wells tested, the well locations, well construction and the timing of tests must be carefully evaluated prior to ground water classification. Further, for each well that has a yield of less than one gallon per minute, it is important to evaluate the depth of the pump intake, water levels in the well before and after the pump test, interval(s) tested, and other factors to verify that the low yield is due to aquifer characteristics and not pump test design, equipment problems, or well construction.

The Tennessee Water Quality Control Act declares that the purpose of the act is to abate existing pollution of the waters of Tennessee, to reclaim polluted waters, to prevent the future pollution of the waters and to plan for the future use of the waters. The ground water does affect the remediation standards for soils above the water table. In many instances it will be more cost effective to address soil contamination. When determining the cleanup levels under limited use, unusable (unless classified as unusable under rule 1200-4-3-.07(2)(e)4.(ii)), and site specific impaired it is suggested to: (1) be consistent with 1200-4-3-.08, (2) determine the nature and mass of contaminants that may be left in the area being classified so as not to violate the applicable ground water classification outside the classification area, and (3) evaluate exposure pathways whereby human and nonhuman receptors may be exposed to contamination.

The limits of the area and depth classified as limited use, unusable, and site-specific impaired ground water are considered classification boundaries. Careful consideration should

therefore be given to the establishment of boundaries.

All classification decisions will be made by the Assistant Commissioner for Environment. The appropriate Division will prepare a memo to memorialize the decision. The Division of Water

Supply shall maintain a list of ground water that has been classified and a summary of how each classification decision was determined. The summary document will be prepared by the Division initially receiving the classification request.

RULE:

(2) The ground water of the State is classified as follows:

(a) Special Source Ground Waters - This is ground water with exceptional quality and quantity, which may serve as a valuable source for water supply or which is ecologically significant. Special source ground water is vulnerable to contamination. Through the rulemaking process, the Water Quality Control Board will amend this rule to include the specific area of an aquifer which receives this designation. The Board shall clearly define the horizontal and vertical boundaries of ground water designated as Special Source Ground Water. In making this decision, the Board shall consider the following factors as submitted by the applicant:

1. The vulnerability of the aquifer, or portion thereof, to contamination due to hydrogeologic characteristics;
2. The number of persons or the proportion of the population using the ground water as a drinking water supply;
3. A comparison of the economic, social and environmental benefits and costs of maintaining the special source ground water with the economic, social and environmental benefits and costs of replacing the special source ground water;
4. An evaluation of the ecological and environmental impact should the quality of the special source ground water be compromised; and
5. Other pertinent information as deemed necessary by the petitioner or the Department.

Because such action is a rulemaking procedure, public input may be made as provided in the Uniform Administrative Procedures Act, T.C.A. 4-5-201 et. seq., but not as a contested case under T.C.A. 4-5-301 et. seq.

GUIDANCE:

Procedure for Classification as Special Source. Groundwater may only be classified as Special Source by the Board promulgating a rule, presumably as an amendment to these rules. Such a rule could be proposed by the Board itself, by a Division making a proposal to the Board, or by the public. The UAPA states that if a request for adoption of a rule is made by a municipality, a corporation, or five individuals, then the agency

must consider the request. See T.C.A. §4-5-201. The particulars of what information the board will want for such decisions will have to be specified by the Board as it takes such an action.

Since it is not a decision that staff has to make under these rules, it is beyond the scope of this guidance.

RULE:

- (b) General Use Ground Water - Except for aquifers, or portions thereof, that have been designated as Special Source Ground Water, all ground water which, as it is encountered, has naturally occurring levels of Total Dissolved Solids of 1000 parts per million or less is classified as General Use Ground Water upon certification by the Commissioner; provided the aquifer or portion of an aquifer can produce an average yield of at least one (1) gallon per minute over a twenty four (24) hour period in a properly constructed six (6) inch water well or a well of alternate construction and equivalent yield approved by the Department. The well shall have three well volumes purged before the twenty four (24) hour pump test begins. Any ground water which is used as a source of drinking water is also classified as General Use regardless of the well yield or the ground water's natural quality, unless that ground water meets the requirements for the Site Specific Impaired classification in 1200-4-3-.07(2)(d).

GUIDANCE:

Because of seasonal fluctuation, variability and other site specific characteristics, yield determination shall be based on an annual representative yield. (See Appendix for discussion of determining well yield.) Any ground water that is or may adversely impact an identified point of drinking water use may not be classified as other than General Use or Site Specific Impaired. The potential for adverse impact shall be evaluated considering factors

such as proximity, direction of ground water flow, hydrologic barriers, fate and transport modeling, etc. (see Appendix).

For purposes of the rules, “encountered” or “encountering” groundwater means the investigation of ground water to determine its nature, quality and/or condition pursuant to the permitting activities or response actions subject to these rules.

RULE:

- (c) Limited Use Ground Water - This is ground water which is not currently a source of drinking water and is classified as Limited Use ground water upon certification by the Commissioner:

- 1. Ground water with naturally occurring levels of Total Dissolved Solids above 1,000 ppm but less than 3,000 ppm; or

GUIDANCE:

TDS will be determined using the current EPA approved methods. See Appendix A for a discussion of TDS determination. However, program staff may utilize their professional judgment to render such a determination in such a case provided that the staff finds – after

evaluation of hydrogeologic conditions and historical water use records in the area – that there is very little likelihood of successfully installing a water well without encountering groundwater with TDS less than 1000 ppm.

RULE:

- 2. Any aquifer or portion of an aquifer which is not capable of producing an

average yield of one (1) gallon per minute over a twenty four (24) hour period in a properly constructed six (6) inch diameter water well or a well of alternate construction and equivalent yield approved by the Department. The well shall have three well volumes purged before the twenty four (24) hour pump test begins; or

GUIDANCE:

See Appendix A for discussion of yield determination.

RULE:

3. Ground water contaminated by human activity previous to November 19, 1980 if:
 - (i) there are no liable parties as defined in T.C.A., 68-212-202 (3) (B), (C), or (D); and
 - (ii) the current property owner did not cause the ground water contamination.

When ground water is encountered and certified by the Commissioner to be Limited Use as described above, the areal extent of the Limited Use ground water shall be delineated. This means the vertical and horizontal boundaries shall be established by sampling from properly constructed ground water monitoring wells, existing water wells and/or springs or by use of other appropriate means; including, but not limited to, topographical evaluations, dye traces, geologic and hydrologic modeling, etc. The horizontal boundaries of the Limited Use ground water cannot extend beyond the perimeter investigated as described above. The vertical boundaries of the Limited Use ground water can not exceed the depth of the ground water investigated as described above. Figures which clearly depict the horizontal and vertical boundaries of the Limited Use ground water must be submitted with the plans/reports required by the response action or permitting action.

GUIDANCE:

Before ground water may be classified as limited use, the horizontal and vertical boundaries of the aquifer portion to be classified must be established to the satisfaction of the Commissioner. In determination of the horizontal and vertical boundaries:

1. *Available drilling and well construction logs for all wells and all available reports that may contain information on the ground water in the area to be classified must be provided.*
2. *Upon review of currently available data, the Department may require*

additional data be gathered.

3. *Vertical and horizontal boundaries shall be determined in accordance with Rule 1200-4-3-.07(2)(c)3.*

Conservative assumptions should be made in defining the area to be classified as limited use ground water. The boundaries of the classified area should not cross property boundaries unless the applicant demonstrates he or she has made adequate notification of proposed limited use classification to all property owners within the portion of the aquifer being classified.

RULE:

Any ground water used as a drinking water source, at the time of classification, regardless of its natural quality or the aquifer yield cannot be classified as Limited Use ground water.

- (d) Site Specific Impaired Ground Water - This is ground water that has been contaminated by human activity and it is not technologically feasible to remediate the ground water to the level required by other classifications or if the costs of such a remediation substantially outweigh the benefits of the restored resource. Ground water shall be classified as Site Specific Impaired upon certification by the Commissioner. The process used to certify ground water as Site Specific Impaired is stated in 1200-4-3-.09.

GUIDANCE:

Sources must be identified and evaluated to determine if the sources will adversely impact the ground water quality at the point of classification

change. For the ground water pathway, cleanup or containment of the source will not be required unless such adverse impacts are demonstrated.

RULE:

1. When ground water is encountered and certified by the Commissioner to be Site Specific Impaired as described above, the areal extent of the Site Specific Impaired ground water shall be delineated. This means the vertical and horizontal boundaries shall be established by sampling from properly constructed ground water monitoring wells, existing water wells and/or springs or by use of other appropriate means; including, but not limited to, topographical evaluations, dye traces, geologic and hydrologic modeling, etc. The horizontal boundaries of the Site Specific Impaired ground water cannot extend beyond the perimeter investigated as described above. The vertical boundaries of the Site Specific Impaired ground water can not exceed the depth of the ground water investigated as described above. Figures which clearly depict the horizontal and vertical boundaries of the Site Specific Impaired ground water must be submitted to the Department in the plans/reports required by Rule 1200-4-3-.09.

GUIDANCE:

If natural attenuation is proposed as a cleanup alternative, the applicant must provide sufficient evidence to support a determination that the contamination is naturally attenuating.

At least when the ground water would otherwise be classified as General Use, one alternative for comparing costs would be to compare the cleanup cost per gallon with the cost per gallon of supplying potable water to the area of the Site Specific Impaired determination. The cost per gallon of running water lines to the area would be included in the cost per gallon of supplying potable water if water lines are not present in the area at the time of the Site Specific Impaired request.

Before ground water may be classified as Site Specific Impaired, the horizontal and vertical boundaries of the area must be established to the satisfaction of the Commissioner. In determining the horizontal and vertical boundaries:

- (1) Available drilling and well construction logs for all wells and all available reports that may contain information on the ground water in the area to be classified must be provided to the Department.*
- (2) Upon review of currently available data, the Department may require additional data be gathered.*
- (3) Vertical and horizontal boundaries shall be determined in accordance with Rule 1200-4-3-.07(2)(d)1.*

The acceptable excess cancer risk level of one in one hundred thousand (10⁻⁵) may be used to be consistent with the excess cancer risk level specified in Rule 1200-4-3-.03. Further, a hazard quotient of one based on individual constituents and a hazard index of one for constituents that have common

toxicological endpoints should be utilized. If desired, the applicant may perform a risk assessment, using the most current scientific technology, to propose site specific risk levels.

Application for a Site Specific Impaired classification shall be in accordance with, and contain the information required in Rule 1200-4-4-.09.

The Site Specific Impaired classification should incorporate a monitoring program along the flow path(s) of the contamination to verify that the aquifer portion beyond the point of classification change is not impacted by contaminant concentrations exceeding applicable ground water criteria.

Institutional controls must be evaluated and applied on a case by case basis. Sources must be identified and evaluated to determine if the sources will adversely impact the ground water quality at the point of classification change. For the ground water pathway, cleanup or containment of the source will not be required unless such adverse impacts are demonstrated.

Following is an example of deed restriction language that may be used as an institutional control.

“The following restrictions shall be placed on the property deed by the current owner before delisting proceedings are finalized.

Installation of any water wells shall be approved by the Department.

Even though Rule 1200-4-3-.07(2)(b) allows water that is being used as drinking water to be classified as Site Specific Impaired, rule 1200-4-3-.08(4) requires the cleanup of site specific ground water to a level that does not pose an unreasonable risk to human health or the environment.

RULE:

(e) Unusable Ground Water - The following ground water is classified as Unusable Ground Water upon certification by the Commissioner:

- 1. Ground water that is mineral, hydrocarbon or geothermal energy producing, or can be demonstrated by a permit applicant as part of a permit application for a Class 11 or III operation under Chapter 1200-4-6, Underground Injection Control, to contain

- minerals or hydrocarbons that, considering their quality and location are expected to be commercially producible; or
2. Ground water at a depth and location which makes its use as a water supply economically or technically impractical; and
 3. Ground water with naturally occurring total dissolved solids of more than 3,000 ppm; or
 4. Ground water that was contaminated by human action in connection with the specific activity referenced below which:
 - (i) is located over a Class III well mining area subject to subsidence or catastrophic collapse; or
 - (ii) has been used to receive fluids and other substances from a Class I injection well, provided the Class I well was approved by the Department on or prior to September, 1985; or
 5. Ground water within the area excavated during the process of mining coal or other minerals pursuant to valid permits. Ground water beyond the excavation area will be classified as it is encountered as described elsewhere in this rule. Ground water which moves from the excavated area and becomes surface water shall be regulated as described in the surface water classification and criteria in these rules.

When ground water is encountered and certified by the Commissioner to be Unusable as described above, the areal extent of the Unusable ground water shall be delineated. This means the vertical and horizontal boundaries shall be established by sampling from properly constructed ground water monitoring wells, existing water wells and/or springs or by use of other appropriate means; including, but not limited to, topographical evaluations, dye traces, geologic and hydrologic modeling, etc. The horizontal boundaries of the Unusable ground water cannot extend beyond the perimeter investigated as described above. The vertical boundaries of the Unusable ground water can not exceed the depth of the ground water investigated as described above. Figures which clearly depict the horizontal and vertical boundaries of the Unusable ground water must be submitted with the plans/reports required by the response action or permitting action. Any aquifer or portion thereof classified for the placement of fluids or other substances by underground injection on or prior to September 1985 shall retain this classification and shall not be subject to the requirements of rules 1200-4-3-.09 and .10.

GUIDANCE:

Written documentation from the Department dated prior to October 1, 1985, will be required to fulfill the requirements of 1200-4-3-.7(e)4.(ii). The excavation is the area where digging occurred, and

does not include the area where the excavated material was deposited.

RULE:

- (f) After the ground water in any specific location has been classified under these rules, a rulemaking action by the Water Quality Control Board will be required to reclassify that ground water.

Authority: TCA. §§4-5-201 et seq., and 69-3-105. *Administrative History:* Original rule filed June 28, 1999; effective September 11, 1999. Amendment filed July 13, 1999; effective October 11, 1999.

1200-4-3-.08 GROUND WATER CRITERIA. The water quality criteria for the different classes are as follows:

(1) Special Source Ground Water:

- (a) except for naturally occurring levels, shall not contain constituents in excess of the concentrations listed in Table 1; and
- (b) except for naturally occurring levels, shall not contain constituents at levels exceeding those in Rule 1200-4-3-.03 except that the criteria for fish and aquatic life and recreational use shall not apply.

(2) General Use Ground Water:

- (a) except for naturally occurring levels, shall not contain constituents in excess of the concentrations listed in Table 1; and
- (b) except for naturally occurring levels, shall not contain constituents at levels exceeding those in Rule 1200-4-3-.03 except that the criteria for fish and aquatic life and recreational use shall not apply

(3) Limited Use Ground Water:

- (a) except for naturally occurring levels, shall not contain constituents at levels exceeding those for the use classifications in Rule 1200-4-3-.03 other than domestic water supply, fish and aquatic life and recreational use; and
- (b) except for naturally occurring levels, in areas where historical contamination causes certain constituents to exceed the levels in rule 1200-4-3-.03, except for the criteria for domestic water supply, fish and aquatic life and recreational use, shall not contain those constituents at levels higher than those background levels; and

GUIDANCE:

The background levels refer back to 1200-4-3-.07(2)(c)3. "Ground water contaminated by

human activity previous to November 19, 1980..."

RULE:

(c) shall contain no substances, whether alone or in combination with other substances, that are toxic, carcinogenic, mutagenic or teratogenic, other than those of natural origin, at levels and conditions which pose an unreasonable risk to the public health

(4) Site Specific Impaired Ground Water:

(a) except for naturally occurring levels, shall not contain constituents at levels exceeding those for the use classification in Rule 1200-4-3-.03 other than domestic water supply, fish and aquatic life and recreational use; and

(b) shall contain no other constituents which pose an unreasonable risk to the public health or the environment; and

(c) shall contain no constituents at levels that will prevent ground waters beyond the point of classification change from meeting the classification and criteria for those waters.

(d) Site Specific Impaired Criteria shall only apply to ground water that has been certified through the process set forth in Rule 1200-4-3-.09.

(5) Unusable Ground Water:

(a) except for naturally occurring levels, shall contain no substances, whether alone or in combination with other substances, that are toxic, carcinogenic, mutagenic or teratogenic, other than those of natural origin, at levels and conditions which pose an unreasonable risk to the public health; and

(b) shall contain no other constituents which pose an unreasonable risk to the public health

Table 1. Inorganic Criteria for General Use Ground Water

| <u>Constituent</u> | <u>Concentration</u> |
|--------------------|----------------------|
| Aluminum | 0.2 mg/l |
| Arsenic | 0.05 mg/l |
| Asbestos | 7,000,000 fibers/l |
| Barium | 2.0 mg/l |
| Cadmium | 0.005 mg/l |
| Chloride | 250 mg/l |
| Chromium | 0.1 mg/l (Total) |
| Copper | 1.0 mg/l |
| Fluoride | 4.0 mg/l |
| Iron | 10.0 mg/l |
| Lead | 0.05 mg/l |

| | |
|------------------------------|------------------------|
| Manganese | 0.5 mg/l |
| Mercury | 0.002 mg/l |
| Nitrate | 10.0 mg/l as Nitrogen |
| Nitrite | 1.0 mg/l as Nitrogen |
| Total Nitrate & Nitrite | 10.0 mg/l (as Nitrate) |
| Selenium | 0.05 mg/l |
| Silver | 0.1 mg/l |
| Sulfate | 500 mg/l |
| TDS (Total Dissolved Solids) | 1000 mg/l |
| Zinc | 5.0 mg/l |

GUIDANCE:

The classification decision will be memorialized in a letter signed by the appropriate Division Director.

This letter will contain the rationale for the decision.

RULE:

Authority: T.C.A. §4-5-201 et seq., and 69-3-105. **Administrative History:** Original rule filed June 28, 1999; effective September 11, 1999. Amendment filed July 13, 1999; effective October 11, 1999.

1200-4-3-.09 SITE SPECIFIC IMPAIRED CLASSIFICATION APPLICATION PROCESS

- (1) Any person who encounters ground water that may meet the requirements for Site Specific Impaired, may apply for the ground water at the site to be certified by the Department as meeting those requirements, using the process set forth in this rule. Any costs involved in making the application shall be borne by the applicant. The application shall include the following, unless it is determined by the Department in writing that the site conditions render any of them unnecessary:
 - (a) An assessment of the horizontal and vertical extent of the contamination;
 - (b) An evaluation of the hydrogeology of the area including but not limited to the ground water flow rate and direction, permeability, recharge area, ground water classification and location of local water wells, springs and seeps;
 - (c) An evaluation of the area geology including but not limited to soil type, soil permeability, soil porosity, depth to bedrock, identification of geologic formations;
 - (d) A description of the corrective actions or response actions taken or proposed;
 - (e) The chemical characteristics of the constituents(s) including but not limited to the constituent's solubility, mobility, toxicity, and carcinogenicity, the nature of and the level of constituents to remain or be present in the ground water as well as the calculations and rationale used in the determination;
 - (f) A feasibility study which evaluates clean-up alternatives, the cost, and the time to

complete each alternative;

- (g) An evaluation of current and future ground water use within a (1/2) one-half mile radius of the contaminant plume; in karst areas the impact of conduit flow shall be evaluated;
- (h) An evaluation of current and future land uses within a (1/2) one-half mile radius of the contaminant plume;
- (i) An evaluation of the potential of the constituent to migrate through soil and ground water to:
 - 1. homes;
 - 2. buildings;
 - 3. surface waters;
 - 4. subsurface utilities; and
 - 5. adjacent properties;
- (j) A description of any existing or proposed monitoring program to observe constituent levels in soil and ground water;
- (k) Evaluation of the existing or anticipated actual exposure pathways (inhalation, ingestion, dermal contact, etc.) of the constituents and an assessment of the human health risks presented by exposure to the constituents as well as the impact, if any, of the constituents on fish and aquatic life pursuant to 1200-4-3;
- (l) Consideration of the classification in Rule 1200-4-3-.07 that would apply to the ground water at the site if it were not contaminated.
- (m) Analysis of the technological feasibility of cleaning up the ground water to the level necessary for the criteria that would apply to the ground water at the site if it were not contaminated and a comparison of the costs of investigation and cleanup and/or any other relevant factors with the benefits of the restored resource;
- (n) A description of how and when the contamination occurred, if known; and
- (o) Other items as requested by the Department associated with the evaluation of the application to certify ground water as Site Specific Impaired.

GUIDANCE:

It is recognized that the level of effort and detailed

documentation required to provide the information necessary for a Site Specific Impaired Classification Application will vary depending upon the

significance and characteristics of the source area, the site of concern and its surrounding area (particularly in the direction of groundwater flow), and the groundwater contamination encountered.

Staff are to use their professional judgment and other programmatic guidance on development of risk based cleanup criteria.

RULE:

- (2) The Department will issue a public notice, unless a process for public notice and input is required by other applicable regulations (in such case that regulation will be followed), when an application to certify ground water as Site Specific Impaired has been reviewed and a tentative decision to approve it has been made. The Department will conduct a public hearing concerning the application if the issue generates substantial public interest. The Department will explain the reasons it is proposing to certify the ground water as meeting the requirements for the Site Specific Impaired classification and will consider all written and oral comments received.

GUIDANCE:

The applicant will identify each party with a recorded interest in the property. Identified parties, contiguous land owners, tenants, and appropriate local officials (e.g. Mayor and/or County Executive) will be notified by certified mail. This is in addition

to the public notice required for SSI classification, and any public notice required by statute or rule. If the Department believes there is sufficient public interest, a notice in a paper of general circulation in the area is suggested.

RULE:

- (3) In the evaluation of an application to certify ground water as Site Specific Impaired, the Commissioner or this Board shall consider:
 - (a) the extent of any threat to human health or safety;
 - (b) the extent of damage to the environment;
 - (c) technology commercially available to accomplish restoration;
 - (d) a comparison of the environmental and economic costs and benefits to be derived from ground water quality restoration with the environmental and economic costs and benefits to be derived from classification as Site Specific Impaired;
 - (e) the point of classification change;
 - (f) other appropriate information presented in the application.

GUIDANCE:

Although ground water that is currently being used for drinking water is eligible for classification as Site

Specific Impaired, such use will be a major consideration in risk analysis

RULE:

Authority: T.C.A. §§4-5-201 et seq., and 69-3-105. Administrative History: Original rule filed June 28, 1999; effective September 11, 1999. Amendment filed July 13, 1999; effective October 11, 1999.

1200-4-3-.10 POINT OF CLASSIFICATION CHANGE.

- (1) "Point of Classification Change" shall mean the boundary location(s) within the relevant zone of an aquifer between the portion of the aquifer that is classified as Site Specific Impaired and any other classification. Compliance with the applicable criteria at this point shall be determined using sampling data, ground water modeling or other allowable mechanisms.
- (2) All areas with ground water classified as Site Specific Impaired must be owned or controlled by the person(s) subject to ground water cleanup or permitting obligations and/or subject to appropriate deed restrictions or other institutional controls. All locations outside the point of classification change must not exceed the applicable ground water criteria beyond the point of classification change

Authority: T.C.A. §§4-5-201 et seq., and 69-3-105. Administrative History: Original rule filed June 28, 1999; effective September II, 1999. Amendment filed July 13, 1999; effective October 11, 1999.

1200-4-3-.11 APPEALS.

- (1) Any applicant aggrieved by the actions of the Department in applying Rules 1200-4-3-.07 through 1200-4-3-.10 may petition this Board for a hearing provided a written petition is submitted to and received by the Commissioner;
 - (a) within thirty (30) days of certification of ground water or disapproval of an application certification of ground water.; or
 - (b) within thirty (30) days following the expiration of the one hundred and twenty (120) calendar days from receipt of an application for certification of ground water as Site Specific Impaired if the Department has not made written request for additional information
- (2) The Commissioner's determination shall be final and not subject to review unless the written petition for hearing is submitted and received within this time frame. The written petition must set forth the basis for the appeal as required by the Administrative Procedures Act, T.C.A. Section 4-5-101 et. seq., and the rules promulgated thereunder, particularly Rule 1360-4-1 -.05.

Authority: T.C.A. §§4-5-201 et seq., and 69-3-105. Administrative History: Original rule filed June

28, 1999; effective September 11, 1999. Amendment filed July 13, 1999; effective October 11, 1999.

APPENDIX A
GUIDANCE ON TECHNICAL ISSUES RELATED TO
GROUNDWATER CLASSIFICATION RULES

This appendix to the guidance on implementing the Groundwater Classification section of Chapter 1200-4-3, General Water Quality Criteria, is designed to provide both regulators and the regulated community with a common starting point in approaching the sometimes complicated technical issues raised by the rules. This appendix should be used in conjunction with the general guidance document and not as a stand-alone guidance. This technical guidance is not intended to provide a one-size-fits-all approach, or to answer all the technical questions that might arise during the process of classifying a particular site's groundwater. Indeed, the site-specific nature of the parameters that must be identified and quantified during that process preclude the development of a rigid set of standards that can be applied state-wide. However, it is desirable that certain aspects of the process be approached in similar ways, whether the site is located in West, Middle, or East Tennessee, and this guidance outlines what variables should be considered and how some measurements might be accomplished.

When approaching the classification of groundwater at a site, it is very important to determine early in the process what technical information will be required. When possible, state agencies and the site owner/operator should work together to define an acceptable approach to the gathering of this information and include this approach in the work plan(s) developed and approved by the agency for the site investigation. In many cases, this will add little or no additional field investigation to what is normally done, but knowing the goals of the process may eliminate confusion and confrontation as the site issues move to resolution.

This appendix is divided into two general sections to reflect the two most significant technical issues facing those who must implement the Groundwater Classification rules:

- 1) how to establish the boundaries of a classified portion of an aquifer, and
- 2) how to determine the yield of a portion of an aquifer.

Establishing Classification Boundaries

At some point in the classification process the question will arise "How large do we draw the box?" In this case, the "box" will be the limits of the portion of the aquifer that is being classified. Chapter 1200-4-3-.07 does not establish minimum or maximum sizes for the classification box, nor does it establish any minimum distance that must be maintained between drinking water sources and non-drinking water classification boundaries. Further, the limits must be drawn in three dimensions, including the vertical as well as horizontal dimensions. The classification boundary for any groundwater classification therefore has to be set on a purely case-by-case basis.

Factors that should be considered while defining the classification boundaries include, but are not necessarily limited to:

- aquifer type (water-table, confined, or semi-confined)
- geology (unconsolidated sediment, fractured bedrock, karst)
- groundwater flow direction and rate
- groundwater recharge and discharge areas
- nature, distribution, and concentration of contaminants in wastes, soil, and groundwater
- proximity of receptor populations
- existing or planned land use
- existing or planned institutional controls
- wellhead protection areas as defined at 1200-5-1-.34

In short, all the factors that go into consideration of a remedial action at a contaminated site should be considered when making a groundwater classification determination. The level of detail needed is, as usual, dependent on the characteristics of the site.

Perhaps the most important consideration in determining the size and shape of the groundwater classification box is the groundwater flow direction. Down gradient receptors are most at risk if contamination is present, and it is desirable to accurately determine the down gradient direction. This is often easily accomplished by simple triangulation on the potentiometric surface. However, there are many cases where flow direction can not readily be determined. These cases include areas with very little gradient and/or areas dominated by karst features. In such areas, more aggressive measures may be needed to establish flow direction, including tracer testing. It is also important to consider seasonal effects on groundwater flow that may result from increased rainfall and the corresponding changes to the potentiometric surface.

The rules require that water that is actually used for drinking be considered general use, but the rules also allow non-drinking water classifications (limited use, site-specific impaired, etc.) to exist immediately adjacent to the drinking water. In determining how close a non-drinking water classification may come to a drinking water source, it may be necessary to determine the radius of influence of the pumping well. This usually requires modeling based on site-specific hydraulic conductivity data as obtained through aquifer testing. Once the flow path to the pumping well has been established, appropriate margins of safety can be determined.

Determination of Aquifer Portion Yield

One of the criteria used to determine if water meets the General Use definition is whether a “portion of an aquifer” can produce an average yield of 1 gpm. In the absence of a water-supply well at the site, this determination will likely be made using wells installed for the purposes of the groundwater investigation, most likely 2-inch or 4-inch inside diameter (i.d.) monitoring wells. To meet the requirements of the rule, the 1 gpm yield must be from a “properly constructed 6-inch i.d. water well or a well of alternate construction and equivalent yield approved by the Department.” Because the proper construction of a water well is dependent on the geology of the aquifer, a wide range of well configurations could meet the “properly constructed” definition, including uncased, open-borehole wells in bedrock and wells screened in multiple water-producing zones in stratified, unconsolidated sediments. Some factors that must be considered in determining the “proper construction” of a well would be:

- length of screen
- screen type
- pump capacity
- amount of penetration of saturated zone
- sanitary protection of the well (depth, type, and sealing of casing)

Pumping tests used to determine aquifer yield must therefore be designed using site-specific hydrogeologic data. The test could be conducted using a 2-inch or 4-inch i.d. well, but the yield would have to be scaled up using a mathematical calculation to provide the yield of a 6-inch i.d. well pumping from the same formation. The following factors should be used unless site-specific determinations are made:

For a 2-inch i.d. well: multiply yield by 1.14 to obtain 6-inch i.d. well equivalent¹

For a 4-inch i.d. well: multiply yield by 1.05 to obtain 6-inch i.d. well equivalent¹

These relationships are true for both unconfined and confined aquifers provided all other variables, including drawdown and screen length, are equal. In other words, if the 2-inch i.d. diameter well is screened over the same length of aquifer as would be a properly constructed 6-inch i.d. well and all aquifer characteristics are the same, the multiplication factors listed above are valid.

It should be noted that the water well design parameter that has the greatest effect on yield is screen length. Conducting a pumping test on a 2-inch i.d. well with a 10-foot-long screen will not result in a yield that can be readily converted to a 6-inch i.d. equivalent if a properly constructed 6-inch i.d. well would have a screen length of greater than 10 feet. For this reason, aquifer characteristics must be evaluated to determine the applicability of any pumping tests used to establish yield. It should be further noted that screen and filter pack type, though important at higher yields, will have a negligible effect at the low yields (1 gpm or less) of interest here.

Different approaches to determining yield may be necessary in different hydrogeologic settings. For a final determination of yield, the rule specifies a 24-hour pumping test, which should allow for the collection of sufficient hydrogeologic data (e.g., hydraulic conductivity, storativity, specific yield) to permit the determination of groundwater flow rates and radius of influence, if such is needed. At least three well volumes must be purged from the well prior to the start of the 24-hour test, then at least 1,440 gallons must be pumped over a consecutive 24-hour period to meet the 1 gpm criteria.

Because of the expense of a 24-hour pumping test, it will probably be desirable to establish early in a project whether or not the 1 gpm threshold will likely be met. The following inexpensive

¹These relationships were calculated from equations presented in *Groundwater and Wells*, Second Edition, by Fletcher Driscoll, 1986.

techniques can be used where appropriate and can easily be incorporated into the groundwater portion of a site investigation:

Unconsolidated/Porous Media

Evaluate data from available monitoring wells, using field observations or data for an initial assessment. For example, if a well bails dry, or purges dry, an approximate 24-hour yield can be estimated without performing a 24-hour test in a 6-inch i.d. well. Some possible situations:

- If standard 2-inch i.d. monitoring wells are bailed dry, evaluate the recharge rate. Use purge rate and recharge rate to estimate the number of gallons that can be removed from the aquifer in a 24-hour period.
- If purge/recharge data indicate that recharge is significantly less than 1440 gpd, and installation of a 6-inch i.d. well and 24-hour testing will likely indicate similar results, the aquifer may be eligible for a limited use classification.
- If purge/recharge data indicate that well yield will be close to 1440 gpd, recommend either 24-hour testing and mathematical correction to a 6-inch i.d. well or actual installation and testing of a 6-inch i.d. well.
- If purge/recharge data indicate that well yield will be over 1440 gpd, the well will likely meet the 1440 gpd criteria in a 6-inch i.d. well.

Fractured Bedrock Media

- 1) Evaluate data from available monitoring wells
- 2) If borehole depths are too large to evaluate discrete zones, perform continuous packer testing, hydrologging, or other methods to assess aquifer yields. Use downhole geophysics to supplement, as necessary, and identify fractured intervals if continuous testing is infeasible.
- 3) Evaluate available data from existing monitoring wells to determine if 1440 gpd criteria can be met continuously, or is a function of borehole/storage volume.

The rule specifies a 1 gpm threshold for determination of whether the aquifer portion is considered general or limited use. The rule does not address the question of seasonal influences on well yield, which must be considered in some areas. The intent of the 1 gpm rule is to provide a distinction between aquifers that can and cannot readily supply water in sufficient quantities for domestic purposes. Although domestic supplies can be made from sources that drop below 1 gpm on an infrequent basis, aquifer portions that can supply less than 1 gpm over a significant portion of the year may be considered limited use. A review of yields of domestic water-supply wells in the same geologic setting as the site in question may provide guidance in situations where yields are marginal.

The rule specifies a 1000 ppm threshold for determination of whether the aquifer portion is considered general or limited use. The rule does not address the question of temporal variability in TDS concentrations. In practice, it may not be appropriate to base this determination on a single sampling event. Aquifer portions that supply water at greater than 1000 ppm on a routine basis may be considered limited use, even if data from a small portion of sampling events show

concentrations less than 1000 ppm. A review of TDS data from residential wells in a similar geologic setting as the site in question may provide guidance in situations where TDS concentrations are marginal.

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